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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/674,675	09/29/2003	Zhisong Huang	LAM1P168X1/P1164X	5003

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EXAMINER
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DEO, DUY VU NGUYEN

ART UNIT	PAPER NUMBER
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1765

DATE MAILED: 04/12/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

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<b>Office Action Summary</b>	<b>Application No.</b> 10/674,675	<b>Applicant(s)</b> HUANG ET AL.	
	<b>Examiner</b> DuyVu n. Deo	<b>Art Unit</b> 1765	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

#### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

#### Status

- 1) ☒ Responsive to communication(s) filed on 09 February 2006.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

#### Disposition of Claims

- 4) ☒ Claim(s) 1-14 and 20-22 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-14 and 20-22 is/are rejected.
- 7) ☒ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

#### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

#### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

#### Attachment(s)

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)  | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                                   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

## DETAILED ACTION

### *Claim Rejections - 35 USC § 102*

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claims 1, 12, 13, 20, 22 are rejected under 35 U.S.C. 102(b) as being anticipated by Singh et al. (US 6,187,666).

Singh describes a method for forming a dual damascene structure comprising: forming a via in an etch layer 60 (col. 4, line 51-52); providing a trench pattern mask over the etch layer (col. 6, line 13-18); forming a protective layer (claimed protective sidewalls) over the sidewall of the vias, the protective layer provide a well defined edges and sidewalls for the via (claimed preventing faceting and fence formation) (col. 4, line 65-67; col. 6, line 21-29); etching a trench through the trench pattern mask and removing the mask (col. 6, line 16-27).

Referring to claim 12, the etch layer includes SiOxFy and polyimide(s) (claimed low-k) (col. 4, line 45-46).

Referring to claim 13, Singh shows the trench is formed using a trench pattern mask and not with any sacrificial filler material prior to the start of the trench plasma etching process (col. 6, line 13-20).

Referring to claim 20, since the step of forming the protective layer on the sidewalls of the vias and etching the trench are two distinct steps. The gas mixtures for both would not be mixed together.

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Referring to claim 22, the trench is formed in the etch layer without a trench stop layer (fig. 17).

3. Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Singh as applied to claim 1 above, and further in view of Hussein et al. (US 6,406,995).

Unlike claimed invention, applied prior art above doesn't describe he via holes are filled with a filler material to no more than 50% of the via hole height prior to the start of the trench etching process. Hussein teaches a method for forming dual damascene structure wherein the via hole is filled with a material to about 50% prior to the start of the trench etching process (fig. 6; col. 5, line 15-48). It would have been obvious for one skilled in the art at the time of the invention to modify the above prior art in light of Hussein because he teaches that filling the via with this material would protect the underlying interconnections during the trench etching process (col. 3, line 1-13).

***Claim Rejections - 35 USC § 112***

4. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

5. Claims 1, 21-22 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. It is not clear wherein the specification teaching of forming a protective sidewalls over the sidewalls of the vias, which prevent faceting and fence formation.

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Referring to claim 21, and 22, fig. 14A and page 25, lines 22-27 do not describe anything about the low-k dielectric layer is with or without a trench stop layer. Therefore, at the time of the invention, the specification does not teach that the low-k dielectric layer is without a trench stop layer.

6. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

7. Claims 1-14, 20-22 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

It is not clear by the limitation “which prevent faceting and fence formation”.

***Allowable Subject Matter***

8. Claims 2-11, 21 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Claims 2-11, 21 are allowable because (referring to claims 2 and 3), Singh doesn't suggest or teach the etching the trench into the etch layer comprises of repeating at least 3 or 5 times the trench cycle of forming protective sidewalls over the sidewalls of the vias, which prevent faceting and fence formation and etching a trench through the trench pattern mask.

***Response to Arguments***

9. Applicant's arguments, filed 1/18/06, with respect to the rejection(s) of claim(s) 1-14, 20-22 under Chu and APA have been fully considered and are persuasive. Therefore, the rejection

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has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made in view of Singh.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to DuyVu n. Deo whose telephone number is 571-272-1462. The examiner can normally be reached on 6 am -2:30 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on 571-272-1465. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

\*Primary Examiner

Duy-Vu N. Deo

4/10/06

